

IMPACT INVENTING: GOING GREEN



About ANDE

The Aspen Network of Development Entrepreneurs (ANDE) is a global network of more than 250 organizations from 150 countries that propel entrepreneurship in emerging markets. ANDE members provide critical financial, educational, and business support services to small and growing businesses (SGBs) based on the conviction that SGBs will create jobs, stimulate long-term economic growth, and produce environmental and social benefits. Ultimately, we believe that SGBs can help lift countries out of poverty. For more information about ANDE, please visit: www.andeglobal.org. To read about small and growing businesses, please visit: www.whysgbs.org.



About The Lemelson Foundation

The Lemelson Foundation uses the power of invention to improve lives, by inspiring and enabling the next generation of inventors and enterprises to promote economic growth in the U.S., and social and economic progress for the poor in developing countries. Established by prolific U.S. inventor Jerome Lemelson and his wife Dorothy in 1992, and lead by the Lemelson family, the Foundation has provide or committed more than \$175 million in grants and program-related investments in support of its mission.

In developing countries, the Foundation works with partner organizations to support inventors and entrepreneurs building businesses that address the problems of the poorest populations through the creation of products that address basic human needs. Within this context, the Foundation works with partners to establish and support programs that inspire youth to become inventors, stimulate and provide invention and entrepreneurship education, and support early incubation of enterprises.



ACKNOWLEDGMENTS

This report was made possible with the generous support and guidance of The Lemelson Foundation, who sponsored a series of roundtables in emerging markets to explore the topic of green inventing. Insights and trends from these roundtables are reflected in this report which builds on a body of knowledge developed by the Aspen Network of Development Entrepreneurs (ANDE) in 2014 that explored general impact inventing trends in global markets.

We are grateful to Avina for providing complimentary funding for the Brazil roundtable, as well as World Transforming Technologies (WTT) and Giral for their in-kind support in Brazil. In addition, ANDE would like to thank SA Innovation Summit for their in-kind support in the South Africa roundtable.

We would also like to thank the ANDE staff including: Alex Pan, Katia Dumont, Bridget Fury, Mary Mwangi, Esther Ndeti, Aditya Pant, Rebeca Rocha, Rosario Uriarte, and Lisa Van Eck for their organization of the convenings, and all of the individuals, including ANDE members, who participated in the research and the roundtable discussions. A special thanks to Natalie Shew for her support in crafting the report. Finally, we would like to thank all of those who contributed to the design and execution of the roundtables.

About this Report

ANDE and many of its members believe that science, technology, and invention-based enterprises based in developing countries have the potential to create innovative market-based solutions to address some of the world's greatest challenges. ANDE also believes that these businesses can generate significant triple bottom-line returns by creating social impact, becoming financially sustainable, and promoting environmental responsibility. In order to do so, however, these businesses need to consider the environmental impact of their products and their operations.

In partnership with The Lemelson Foundation, ANDE hosted a series of roundtables in 2015 and 2016 in Brazil, India, Kenya, Mexico, and South Africa that focused on the challenges and opportunities in promoting environmental sustainability for inventors and invention-based enterprises in emerging markets. These roundtables gathered important global, regional, and local actors participating in invention, innovation, and entrepreneurship to discuss the unique challenges and opportunities for environmentally-focused businesses or "green enterprises".

In particular, these roundtables explored the unique areas where "green inventors", or invention-based entrepreneurs who promote environmental responsibility, require ecosystem-level support. As a result, this report recommends how ANDE members and others, might help green invention-based businesses grow, while suggesting ways entrepreneurial ecosystems might better adapt to meet the unique needs of green inventors.





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EXECUTIVE SUMMARY

“Inventing green” is the concept that invention-based businesses focusing on developing commercially viable, environmentally sustainable products can have a positive social and environmental impact, while also becoming financially sustainable. This idea requires equipping (or matching) green inventors with entrepreneurial skills in order to market and sell products effectively. ANDE believes that invention-based entrepreneurs are supported or impeded by a number of environmental factors called, the entrepreneurial ecosystem. This ecosystem includes access to capacity development, markets, finance, talent, and effective policy and regulation.

Green inventors and entrepreneurs in emerging markets face unique challenges, but in an age of rapidly advancing technology, ANDE has also identified a variety of opportunities for success. For example, invention-based business can have a positive environmental impact through the creation and distribution of clean technologies that directly address environmental challenges. At the same time, inventors can work to minimize the negative environmental impacts of their products through environmentally sustainable practices in areas such as design, prototyping, and manufacturing. The goal of the roundtables was to explore both approaches. While new products are needed to solve pressing environmental problems, it is also critical that hardware entrepreneurs consider the impact that their products have on the environment around them.

ANDE builds upon findings detailed in a report entitled, *Impact Inventing: Strengthening the Ecosystem for Invention-Based Entrepreneurship in Emerging Markets*, which broadly highlights challenges and opportunities for invention-based entrepreneurs. Based on these findings, ANDE explored additional challenges that hardware businesses face when attempting to create environmental benefits, or limit their environmental impact through their inventions. In addition, this report analyzes both of these challenges in light of local and regional contexts.

When ANDE began discussing the idea of hosting the green inventing roundtables with its members, a majority of the organizations immediately began thinking about clean technology solutions to address environmental issues. While that was one way to assess the environmental impact of green inventing; another goal of the series was to push the sector to think more broadly about the impact of entrepreneurs on the environment through an entire product life cycle.

With this in mind, the roundtables served as a first step in engaging developing countries' small and growing business (SGB) support organizations in this broader conversation. Therefore, it does not come as a surprise that the suggested ways to better support green inventors includes a diverse set of ideas. In many of the markets where the roundtables took place, the idea of taking a green inventing approach is still nascent.



ANDE's recommendations include ways to improve the finance landscape and market structure for green SGBs; sustainable design, prototyping, and manufacturing processes; the regulatory environment; capacity development services; and the role of Transfer Technology Offices (TTOs) and universities. ANDE specifically recommends that industry actors consider:

- **Generating awareness** of the importance of green inventions that directly address environmental issues
- **Generating awareness** of the need for invention-based businesses to use new mechanisms and technologies to limit their environmental footprint
- **Identifying and mapping intermediaries** who support entrepreneurs in different business stages and making this information available to inventors and entrepreneurs
- **Promoting funds** that are environmentally sustainable and provide financial opportunities aligned to the specific needs of invention-based entrepreneurs
- **Creating green impact bonds** in order to lower the cost of financing green inventions
- **Encouraging government entities** to work alongside green inventors to build more effective policies in technology transfer, research, procurement, fiscal incentives, and trademark and patent registration

- **Working with governments** to create policies that incentivize invention-based businesses to limit their environmental footprint
- **Educating green inventors** on why metrics are necessary for accurately measuring environmental impact
- **Facilitating metrics training** programs for green inventors and investors

**Note: A full list of recommendations is included later in the report.*

In light of the aforementioned recommendations, it is apparent that there are many ways entrepreneurial ecosystems can be improved to support green invention-based businesses. If the ecosystem components mentioned in this report are adequately nurtured, green SGBs have the ability to create highly marketable and impactful products for the benefit of local communities and the larger global community. However, there are still many challenges that must be overcome in order to make green inventing successful.

INTRODUCTION

BACKGROUND

In 2014 and 2015, ANDE partnered with The Lemelson Foundation to host an initial series of roundtables that engaged organizations who are actively supporting (or interested in supporting) invention-based businesses. Since then, this type of entrepreneurship has been coined, “impact inventing.” In the report entitled, *Impact Inventing: Strengthening the Ecosystem for Invention-Based Entrepreneurship in Emerging Markets*, ANDE highlighted that a growing segment of social entrepreneurs and small and growing businesses (SGBs) was emerging that seeks to utilize the power of invention to create products and companies that improve the lives of people living in poverty around the world. This type of entrepreneur who aims to develop and disseminate tangible products that will be manufactured and sold at high volumes via market mechanisms is an invention-based entrepreneur. In this first report, it was purported that invention-based entrepreneurs are aided or impeded by a number of factors, which are collectively called the entrepreneurial ecosystem.

The findings in the first report hinge on the following key areas where the ecosystem could be strengthened to better support invention-based entrepreneurs:

- Improved mapping and dissemination of available resources
- Creation of a community that supports invention-based entrepreneurship
- The facilitation of partnerships with universities
- Articulation of scalable value to corporate partners
- The unlocking of finance by closing ecosystem gaps

Since then, ANDE and The Lemelson Foundation were keen to delve deeper into this topic to understand the nuanced needs of a subset of invention-based enterprises focused on addressing environmental sustainability both in the products they produce and the ways in which they run their businesses.

THE OPPORTUNITY FOR INVENTING GREEN

As part of an effort to propel entrepreneurship in emerging markets, ANDE convened members and expert stakeholders in Brazil, India, Kenya, Mexico, and South Africa for a high-level, interactive discussion on the opportunity for invention-based SGBs to create positive environmental impacts and promote greater environmental sustainability. ANDE convened roundtables in 2015 and 2016

to explore existing resources, ecosystem-level challenges, and actions that can be taken to address critical gaps.

This report is primarily geared towards ecosystem actors and the intermediaries who support green invention in emerging markets such as capacity development providers (CDPs), investors,



policymakers, universities, research centers, Transfer Technology Offices (TTOs), consultants, nongovernmental organizations, and corporations.

Green invention and invention-based businesses that incorporate environmental sustainability, have a unique ability to improve the economic livelihoods of those at the base of the pyramid by creating jobs and significant economic returns. They also mitigate pressing environmental concerns on a global level through the creation of sustainable products. The ability of invention-based businesses to succeed is largely determined by the quality of their entrepreneurial ecosystem.

This ecosystem includes comprehensive capacity development, access to markets, access to finance, effective policy and regulation, and access to metrics. If the ecosystem of a business

is healthy and thriving, green invention-based businesses can potentially produce triple bottom-line returns by becoming financially sustainable, creating social impact, and encouraging environmental responsibility.

The remainder of this report explores the state of play for each component of the ecosystem that requires improvement including capacity development, finance, policy, and metrics. The report concludes with a list of recommended improvements for ANDE members and others to consider.

IMPACT INVESTING: GOING GREEN

CAPACITY DEVELOPMENT

Capacity development providers (CDPs) support SGBs throughout their life cycle via training, mentoring, consulting, and other support services. When compared to traditional entrepreneurs, green inventors are typically more focused on the research and development of their products and often need additional support in turning their ideas into businesses. Accordingly, CDPs are ideal intermediaries for helping green inventors understand their markets, create business goals, access financial opportunities, and identify potential customers.

The challenges that arise when developing the capacity of green inventors are threefold: in some instances there are available resources, but inventors are not aware of them; in other cases there is a need for additional support that does not currently exist, and sometimes there is a need to further adapt existing support to meet the unique needs of green inventors. In the roundtable discussions, representatives from each country presented the various capacity needs of green inventors and noted the expertise of local CDPs that green inventors could utilize. However, local CDPs advising on environmental sustainability are not always well-equipped to address the challenges that green inventors encounter.

In order to provide better support to green inventors, local CDPs need to address the following problem areas:

- **Sustainable prototyping and the innovation process**
- **Industry specialization (i.e. agriculture and biotechnology)**
- **Branding and marketing environmental sustainability**

The Innovation Process and Sustainable Prototyping

Challenges

A crucial feature of successful green invention is prototyping and industrial design, i.e., getting prototypes ready for production and scale. This is an area where capacity development providers currently fall short in each market we explored (including Brazil, India, Kenya, Mexico, and South Africa). The challenges in each country are marked by gaps in new technology research; gaps in exposure to global trends and emerging technologies; lack of collaboration between incubators and universities; and lack of knowledge about human-centered design techniques. There is also limited access to prototyping software and sustainable prototyping because access is primarily relegated to universities and large companies. To illustrate, in Kenya and Mexico, some universities are currently setting up incubation centers, but accessing them is a long and complicated bureaucratic affair. All of the roundtables mentioned the existence of stalled technologies in local universities that remain in the research phase. In other instances, it was noted that universities work on similar green innovations, but in isolation, thereby creating redundancy.

Green inventors across markets struggle to access technical assistance in the form of research centers, laboratories, and scientists. For example, a representative in the Kenya roundtable discussed the lack of training for electrical engineers to be certified to international standards. In India, participants highlighted that inventing in the hardware sector is more challenging than in the software sector because most green inventors have never thought of entrepreneurship as an option



for developing their prototypes. In light of this gap, roundtable participants highlighted the need for more training and collaborative platforms to support the development of sustainable prototypes that address the needs of local communities.

In addition to design support, accessing legal and financial support during the prototyping phase is necessary, but often not available. Often inventors have limited experience benchmarking their intellectual property filings against existing ones for the sake of improving their products. In the Kenya roundtable, it was noted that the process of filing and gaining patent recognition is tedious; as such, more focus should be placed on making the patent process shorter and less complicated in order to encourage innovation. Similarly, in India, patenting is the biggest challenge impeding hardware invention, and it is difficult to ensure a prototype is not copied when an inventor shares it with friends or potential investors.

Opportunities

Improving sustainable prototyping for green inventors should begin by encouraging partnerships between inventors and incubators to train and develop more inventors in eco-design. In the South African roundtables, organizations such as the Eco-innovation Program at the Bertha Center of Social Innovation and Entrepreneurship¹

and the United Nations Design for Sustainability² program were referenced for their work in this area. Organizations like these help companies develop a plan for thinking through sustainability issues, as well as develop curricula and programs and formulate a business case for sustainability. Another resource to help fill this gap in prototyping is the Hasso Plattner Institute (HPI) School of Design Thinking (d.school)³, which provides open design-thinking courses at the University of Cape Town's Graduate School of Business.

Incubators and universities could also collaborate to create classes where inventors are trained in a particular skill and then have a platform to pass on the knowledge and skills to others. The Sinapse da Inovação program⁴, created by Fundação Certi in Brazil, has a program where students, professors, and innovators can apply through a portal to receive specific training and seed funding to turn innovative ideas into companies over an 18-month period. The program has partnerships with local universities, government entities, and development agencies, and has seeded 294 companies to date. In the Brazil roundtable, a recommendation was made to connect different capacity developers with Sinapse da Inovação in order to train inventors in social entrepreneurship, impact investment, and social impact measurement as they develop their ideas.

SGB Spotlight on Brazil

Brasil Ozônio develops and sells low-power systems that use ozone to treat water, air, and waste instead of conventional chemicals. With advanced technology, the BR03 system consumes little energy, produces no waste, and is cost-effective for the consumer. It also removes 99.9% of bacteria, viruses, and microorganisms, and oxidizes heavy metals such as iron, uranium, and manganese. It has a wide range of uses from deodorizing cigarette smoke in hotel rooms to sterilizing surgical materials and industrial wastewater treatment. A single unit of BR03 can purify 3,000 liters of water per hour and meet the water needs of 3,600 people a day. Even with high volumes treated, its monthly power consumption is about the same as a domestic refrigerator, making its operational costs close to zero.



Brasil Ozônio was founded ten years ago and incubated by CIETEC, the Technological Incubator at São Paulo University. With a diverse team in charge of operations, Brasil Ozônio has already developed more than 70 different applications for the BR03 technology in order to serve customers of all sizes and contexts, ranging from small communities to large industries. After analyzing and comparing over 150 technologies for water treatment around the world, World-Transforming Technologies (WTT) selected it as one of the leading technologies to be implemented in low-income urban and rural communities.

Mexico has several new laboratories and research centers that support talent development and the formation of teams with a mix of technical and business development skills. There are also multiple CDPs for green inventors, particularly for prototyping support such as the National Institute of Entrepreneurship (INADEM)⁵. Similarly, ImpactMX⁶ gives green inventors access to laboratories, infrastructure, materials, and specialized mentors for their projects. Importantly, these programs also connect green inventors to financial support in the forms of private and public funds, as well as regional clusters and chambers of commerce. In Kenya, Gearbox⁷ creates access to the invention environment for entrepreneurs interested in green

inventing. Also, JKUAT⁸ offers opportunities for green technological innovation training, while Strathmore University⁹ offers USAID-funded environmental training programs that are often subsidized or free for women.

Industry Specialization

Challenges

Currently, there is a lack of specialized training from CDPs that focus on the nuances of green innovation in specific industries. Innovative green technologies are being created every day in agriculture, biotechnology, and energy, but in many cases they have not yet reached a

sustainable level. Green inventors are in need of outside expertise to ensure their green technologies are user-friendly, while not being cost prohibitive for consumers.

For example, in Brazil, deeper specialization in recycling would make a significant, positive environmental impact, but there is a gap in the economic mechanisms to support investments in recycling, which prevents the industry from growing. Similarly, Mexico has strong CDPs focused on inventions for other sectors, but there are very few CDPs specialized in green invention and clean technology. Incorporating more specialized and diverse teams of inventors and entrepreneurs is needed in order to strengthen the development of green invention in specific sectors. A representative in the Kenya roundtable mentioned that accelerator programs often make generalizations about the challenges involved in green invention without conducting investigative research into specific sectors.

Opportunities

The overall consensus across roundtables was that green inventors would benefit from specialized accelerator programs that help them tailor their products to applicable industries through better research and feedback. For example, GreenCape¹⁰ is a development agency in the Western Cape province of South Africa that facilitates investment and employment opportunities in green business, manufacturing, and technology. This organization can help an entrepreneur that has already found a technology that works, e.g., solar PVs, but requires further assistance in tailoring the product to the market. Similarly, Fetola's¹¹ green business development support program called, #JustAddGreen, enhances small and medium business enterprise involvement in the green economy of South Africa.

Regarding general green innovation industry support, universities like the National Autonomous University of Mexico (UNAM)¹² and

UNITED NATIONS DESIGN FOR SUSTAINABILITY PROGRAM DEFINES DESIGN FOR SUSTAINABILITY (D4S) TECHNIQUES AS

“interventions similar to those used in cleaner production audits, such as increasing energy efficiency, using recycled materials, designing for recyclability, reducing toxic materials, extending product life, and providing services in new ways. Life cycle analysis and supply chain management are more precise tools for evaluating material flows and environmental impacts in a product's life cycle, and can help designers identify additional improvements”.

the National Polytechnic Institute (IPN)¹³ have increased their roles in the environmental aspects of development in Mexico by adapting their courses with softs-skills development and innovation, as well as including more technical career paths in information technology, biotechnology, engineering, and agriculture. They have also included business development courses, which have inspired a new wave of innovative entrepreneurship. Mexico is currently investing in infrastructure for environmental sustainability, with coalitions such as the Mexican Innovation Centers on Renewable Energies (CEMIE)¹⁴, which integrate universities and research centers that work to develop specialized technological knowledge on renewable energies, as well as corporations and government institutions interested in using them.

Overall, participants in the roundtables agreed that a solution to the industry specialization gap is best accomplished by creating partnerships between local NGOs, green entrepreneurs, inventors, and investors.

There were many suggestions under the umbrella of collaboration:

- A “boot-camp” that brings together key stakeholders to advance progress in the green inventing ecosystem
- The provision of training spaces that would assist in capacity building and create a support network for entrepreneurs
- Empowering entrepreneurs to mine for information in light of the fact that information access is a challenge
- Intellectual property professionals should train experts in robust innovation and quality control
- The university curriculum should be aligned to accelerators, and research incentive structures should change from publication-centered incentives to commercialization-centered incentives

Branding and Marketing Environmental Sustainability

Challenges

Green inventions create value, but in order to avoid market failure, there is a pressing need for better consumer education on the benefits of these inventions. Some people will pay a premium for green products, but a majority of the market will not. In general there is a gap in defining “green invention” since participants in various sectors of innovation have different ideas of what “green” means. Often consumers do not understand how a green product benefits them. In addition, there are many obstacles for green inventors to enter a market and few platforms to aid partnerships with the public sector or corporations.

In addition, green SGBs often lack the operational capacity to integrate into the value chains of large corporations who can pay for this kind of technology. To illustrate, FEMSA¹⁵ and Walmart are currently working to integrate green SGBs into their value chains in Mexico and also provide programs to identify potential green inventors in order to support them and grow their inventions; however, it is not yet clear how to improve access to these large corporations, or how to share these kinds of best practices with other corporations. Similarly, in South Africa, corporations display limited appetite to integrate green products into their supply chains, as cost takes precedence.

Improvements in defining and branding “green invention” are necessary because the market is currently not well-versed in the nuances of green products. Consumers are not willing to invest in these products simply because they are environmentally friendly; there would have to be a financial incentive for buying green products. The bottom line is always the cost of the product, and “green” often equates to “more expensive.” For instance, a positive marketing feature for the cook stove in India was that the cook stove provided savings on fuel. The challenge for marketing this green invention was getting the customer to recognize the overuse of fuel as a problem. When a customer does not understand what an invention aims to fix, a change in the message is required.

Opportunities

When it came to addressing issues around product marketing, the roundtables centered on the important question of which assessment should come first for green invention: product viability or economic viability. One solution presented was that all products must begin with a market demand. The corporate market is changing in terms of consumer responsibility; consequently, many corporations are looking for green technologies to produce and sell for the purpose of environmental and financial sustainability. Corporations can play

SGB Spotlight on India

Inficold provides access to life-transforming cooling and refrigeration technologies in under-served markets by enabling uninterrupted operation of mainstream appliances during power outages. India's frequent power outages lead to low adoption of air-conditioning for the emerging middle class: only four percent of households have air conditioning in India, whereas 87 percent have it in the US. Power outages also lead to significant food waste, as only 10% of produce passes through energy-intensive cold chains. Inficold is developing a thermal storage battery that enables affordable offgrid operation of air conditioning and cold storage refrigeration systems for customers with an unreliable or intermittent power supply. Inficold's thermal battery is a plug and play power backup solution that can retrofit onto existing cooling systems, removing the need for dirty diesel generators and expensive electrical batteries for off-grid and under-served on-grid customers.



a role in seeding the market for green products by generating green alternatives to products, but there must be a bottom-line incentive for these corporations to do so.

The private sector can offer marketing assistance by developing networking opportunities for inventors to showcase their products to investors and consumers. Some CDPs promote the integration of more specialized marketing talent

into start-up teams. Currently, services providing marketing mentorship are being offered by programs such as New Ventures¹⁶ and Green Momentum¹⁷ in Mexico. Similar to the private sector, the public sector can provide another facet of support to green inventors through partnerships that open up unique market opportunities through trade shows or chambers of commerce.

FINANCE

Several challenges were identified in the roundtables including investors' limited understanding of given technologies, their limited appetite for risk, and long pay back periods; thereby making green inventions less attractive than another types of businesses. Understanding and articulating the business case for sustainability is an important part of obtaining funding for green inventions. During the roundtables, participants primarily discussed the need for the development of unique financial opportunities to support the customized needs of green inventors. Another area of interest was the idea of incentivizing traditional inventors to consider how to incorporate environmental sustainability into more traditional business models. Given the limited availability of commercial bank finance for green products, the primary focus of discussion in the roundtables was on:

- **Public green funds**
- **Private investment firms**

Public Green Funds

Challenges

Interestingly, the roundtables identified a number of public fund structures that could be leveraged by green SGBs in Brazil, India, Mexico, Kenya and South Africa. These fund structures are created by local governments who recognize that they need to focus more on the environment so they have developed funds to incentivize innovation in the green economy. However, in most cases entrepreneurs are not aware of opportunities available to them provided by the public sector. At the same time, private investors may have limited insight into which public sector offerings exist. On both sides, there is a marketing challenge and lack of awareness of new resources. Meanwhile, many public sector organizations have had trouble

making the link between green inventions and job creation, which is often a key metric for securing future funding. For those public sector funds available, they often focus almost exclusively on green energy solutions and often fail to diversify their investments.

Opportunities

The approximately \$130 million Green Fund¹⁸ in South Africa assists in the development of the green economy by supporting initiatives that reduce environmental harm. The Green Fund recognizes that the green economy in South Africa is centered on lowering carbon emissions and providing resource efficiency from an environmental and social perspective. The goal of the fund is to build an evidence-base for the green economy by being a catalyst fund that seeds early stage demonstration and commercialization. After providing early-stage financing, the goal is for the private sector to invest in enterprises with follow-on funding. By providing grants and concessionary loans at a five percent interest rate, the public sector attempts to avoid crowding out private sector funders. The Green Fund has also funded green CDPs to support businesses alongside investments.

In Mexico, there are public funds available from the Secretariat of Economy, CONACYT¹⁹, INADEM⁵, the Secretariat of Energy (SENER)²⁰, and NAFIN²¹ (National Finance). Similarly, in Kenya, a representative from the NETFUND's²² green innovation award discussed their open call for applications from green innovators whose businesses offer solutions in one or more of the following areas: energy, waste management, water, and agri-business. Other similar green public firms mentioned in Kenya include: USAID's Feed the Future Program²³ and Kenya Climate Innovation Center (KCIC).²⁴ In Brazil, BNDES²⁵, FINEP²⁶, and Fapesp²⁷ all invest in environmental

innovation, science, and technology. These players are the main fund sources for green invention in Brazil. Overall, there are a number of public

funds that can be utilized to help finance green invention.

SGB Spotlight on Mexico

Sistema Biobolsa³⁴ provides small-scale farmers with renewable electricity and thermal energy to power agricultural and domestic activities by transforming organic waste into biogas and using it to power generators and appliances. The Biobolsa technology and distribution model make high-quality biogas systems and services more accessible. Since 2010, more than 3,000 systems have been installed in Mexico and eight other countries in Latin America and the Caribbean, serving more than 15,000 people.



Sistema Biobolsa has the potential to reach 3.5 million farms in Mexico and 1.5 million farms in Central America to produce renewable energy. Having renewable energy readily available means that farmers and their families spend less time on domestic activities and potentially have more productive farms that earn higher incomes, while also creating new opportunities for educational advancement for farmers and their children.

Private Investment Firms

Challenges

A limited number of investors have the skills to evaluate all of the components of invention-based companies, and even fewer have worked with environmentally focused start-ups in emerging markets. Financing green technologies requires intensive upfront capital over a long payback period, and few private investors are able to provide the early-stage risk capital that is necessary for prototyping and design. Many green investors also lack the commercial understanding and business model development that investors are looking for, and they do not spend enough time with invention-

based entrepreneurs in order to gain insight into the value of the product at hand. Additionally, commercial banks rarely offer customized products for green inventions, which thereby causes an overarching early-stage funding gap in the green space.

Opportunities

Despite these challenges, there are investment firms who are willing to invest in green invention if the business models are sustainable and the right financial tools are in place. Additionally, there are other private organizations who exist to connect entrepreneurs to investors with similar impact-driven goals.

In the Mexico roundtables, intermediaries exist to connect financial resources to green SGBs including: Green Momentum¹⁷, New Ventures¹⁶, Sensecube, ImpactMX⁶, SIP innovation³⁰, and CINVESTAV³¹, among others. There are other private funds like ENGIE and DESUS that invest directly in green inventors, tailoring specific funds to the enterprise's needs. ENGIE has invested in companies like Sistema Biobolsa³⁴ and Ilumexico³⁵, using different financial mechanisms. In Brazil, World Transforming Technologies (WTT) has emerged as a solution to the lack of funding by identifying early-stage ideas, developing them, and finding investors to commit early-stage financing.

In South Africa, Ashburton Investments highlighted their need to focus on the social job creation potential of green inventions since social inclusion and sustainability commonly fall within the definition of “green” in South Africa. Representatives expressed interest in investing in models that are sustainable, specifically related

to job creation in the green space. The CTI Private Financing Advisory Network (CTI PFAN)³⁸ does not provide direct finance, but instead provides services to inventors in the climate change sphere and helps them speak the language of financiers. Furthermore, Green Cape¹⁰ has a green finance desk with 80–100 sources of funding via grants that are energy focused; they are ready to invest in green invention, but still struggle to find investment-ready companies.

Notably, microfinance could be an effective solution for improving finance efficiency for green inventions that are not market ready, further helping fill the gaps in early-stage funding. Often, only a small amount of capital is needed to fund a particular project in a company, therefore a small loan could go a long way.

Additionally, commercial banks could improve their social responsibility efforts by creating green finance packages, specifically for green

SGB Spotlight on South Africa

All Women Recycling³⁷ is a small business based in Cape Town, South Africa that trains women who have been unemployed for more than two years with the skills needed to create products made from recycled materials. South African women learn business management and sales skills, in addition to the technical training provided to make products for distribution. For example, the kliketyklikbox™ product is an eco-friendly gift box made from plastic beverage bottles. Approximately 350 kliketyklikboxes™ are produced daily and are supplied to more than 30 retail outlets globally. Approximately 60% of the ecofriendly gift boxes are exported to Germany, Switzerland, the United Kingdom, the United States, and Australia. Products are also sold at retail outlets in South Africa including Starke Ayres, Moyo, Wellness Warehouse, Kwalapa, Tainted Love, Old Joes Kaia, and Londelozi.





entrepreneurs to help fill some of the funding gaps SGBs experience in accessing upfront capital. By doing this, commercial banks would

gain the advantage of partnering with sustainable industries in promoting green entrepreneurship.

SUPPORTING INVESTMENT READINESS

One solution to the current financing gaps is finding organizations who will help inventors package their ideas with market research and customer surveys, as well as financial projections. Inventors benefit from building teams that incorporate accountants, business experts, and marketing specialists to promote financial sustainability and negotiate with investors. Furthermore, contracting individuals part-time rather than hiring full-time for their services is a better option for start-up entrepreneurs. Regarding communication, one helpful addition is a Quoralike platform through which investors and entrepreneurs can ask and answer questions, as well as discuss impacts and expectations. In looking at performance indicators such as environmental impact metrics, showing how funding will be effective at delivering the desired outcome is crucial.

POLICY

In most markets, government regulation and policy play an integral role in building markets that incentivize environmental sustainability. In these roundtables, we explored the various roles that governments play in promoting environmental sustainability in emerging markets. This is a critical component for green inventions because green businesses are often built to take advantage of certain policy incentives; thus, they face significant risk if a policy is changed. Accordingly, investors and CDPs should be encouraged to account for policy risk when working with environmentally focused SGBs.

The following policy features are outlined in this report:

- Policy incentives
- Policy risks

Policy Incentives

Challenges

Governmental efforts are needed to promote the social inclusivity of the green economy through incentives. The roundtables concluded that the government should play a stronger role in integrating different ecosystem actors and creating policies that support new opportunities for green inventors. Gaps exist in the current legislation in terms of fiscal incentives and legal affairs to make patenting and registration an easier and cheaper process for green inventors. Also, governments and corporations are not incentivized to incorporate green businesses into their supply chains. In order to achieve this, policies must be made that play a role in building markets that mandate environmental sustainability. Furthermore, platforms for public sector engagement with innovators are necessary, but unfortunately still lack a collaborative format where innovators and policy-makers can come together to solve problems.

SGB Spotlight on Kenya

Afrisol Energy Ltd³⁹ designs and manufactures biogas digesters to provide sustainable solutions in waste management, water, energy, and planning and design. The company has installed more than 120 biogas digesters in Kenya that convert biomass and manure into cooking gas and electricity in under-served communities.

Afrisol Energy has installed a bio latrine facility at Mukuru Kwa Njenga, a school in one of Nairobi's informal settlement areas. The latrine produces 15 kilowatts of electricity to light classrooms and power street lights to improve security in the neighborhood. In addition, the company is working to create a culture that supports a greener future by creating job opportunities for young people. Afrisol trains youth in Mukuru in biogas installation and employs them after they have completed the course.



MEXICO AND THE PUBLIC SECTOR

The public sector plays a relevant role in green invention in Mexico, as they are the key players in financially supporting green inventors in the research stage through CONACYT. The government also helps with other funds from INADEM, NAFIN, and the Secretariat of Energy (SENER), who support early and later-stage businesses. In terms of intellectual property, the Mexican Institute for Industrial Property (IMPI) offers a variety of services to green inventors. One of the benefits is a 50% discount for patent registration, and another is support for inventors throughout the registration process that facilitates administration and decreases costs. The Mexican government understands that they need to collaborate with capacity developers and research centers who are experts in green invention. The government also helps negotiate public-private partnerships that ensure financial support, as well as access to larger markets that promote long-term growth.

Opportunities

The way governments incentivize green invention makes a significant difference in the success of green inventions in a given country. Consequently, it was recommended that local governments work to create an inclusive green economy with a deep understanding of the profit incentives the private sector needs in order to develop green products. Specifically, policy-makers can do more to ensure the informal economy is not disconnected from the formal green economy consumers and suppliers. Accordingly, enabling jobs in environmental sustainability helps reduce negative environmental impacts, while also decreasing the unemployment rate through job creation. For example, in Kenya there has been a recommendation to ban the importation of green products that are locally available to ensure local jobs and sales revenue.

Furthermore, roundtable participants recommended that public funds pay for the public good features of green invention, while the private

sector pays for the commercial features. In the South Africa roundtable, policies to incentivize activity in the green economy were mentioned including the Renewable Energy Independent Power Producer Programme (REIPPP), which has significantly reduced the price of wind and solar power, creating a more competitive energy industry in the country. Meanwhile in the Brazil roundtable, it was noted that the National Development Plan in Brazil could create government-sponsored mentoring programs to encourage entrepreneurs to explore green invention. Across countries, it was noted that awareness about existing policies that support and aid in the innovative process could be increased. A good example is the Kenya Science and Technology Act, which stipulates that the government will contribute two percent of the country's gross domestic product (GDP) towards a fund in support of innovation.

Policy Risks

Challenges

Policy risks for green inventors come in many shapes and sizes. Influential stakeholders in green invention must focus on where regulation blocks or stalls innovation and figure out how to reform those policies. In some instances, local governments may not see innovation, e.g., renewable energy, as a financial benefit because the existing alternative generates revenue for the city. In Mexico, for example, the government offers so many subsidies to individual consumers for access to electricity that there is no awareness of the potential financial benefit of alternative energy sources. In India, waste management is largely a local government concern that is driven by changing policies. Therefore, investors are often wary of investing in an innovation that may become useless if a policy change occurs. Another challenge for green inventors is the lengthy process required to pursue patenting and licensing; this often deters or slows down inventions from reaching the market because of the sheer level of complexity and difficulty in managing bureaucracy.

Opportunities

It is critical for entrepreneurs and governments to collaborate to reduce the potential policy risks that prevent - or stall - green invention. Partnerships between invention-based entrepreneurs and governments can be beneficial because governments are often bound by slow-moving regulation, but entrepreneurs are able to innovate at a faster pace. This can lead to opportunities for governments to source local solutions that are more affordable to international alternatives. Several green entrepreneurs have been successful in first formulating their own business plans independently from the government, and then working with government entities to create and improve policies. Also, case studies from other countries involving government intervention in the innovation sector are being used successfully as

resources for promoting effective policy change. Furthermore, government entities and green entrepreneurs could collaborate and solve some of the legal issues related to patenting and licensing through information sharing platforms and policy changes for green inventors to more easily patent their inventions.

METRICS

Metrics and measurement underpin many of the other factors in cultivating a healthy ecosystem for green inventors. Current metrics frameworks are not well-suited for many businesses working in the environmental sustainability sector. It is important to uncover alternative metrics for green inventors that are more appropriate. Furthermore, environmental impact metrics are expensive and difficult to collect, and green SGBs require support from intermediaries in accessing and using metrics effectively. The following needs were identified throughout the roundtable series:

- **Availability of reliable data**
- **Expense of environmental impact metrics**
- **Intermediary support**

Challenges

Environmental impact metrics are necessary for green inventors to understand how they impact the environment in areas such as pollution reduction, water consumption, and carbon reduction, as well as to track their effectiveness in reaching vulnerable populations in order to provide them with access to services such as clean energy and water. Metrics are also a necessary tool for green entrepreneurs because they aid in understanding outcomes in terms of sales, investment attraction, and marketing; however, the countries in this report have limited access to metrics or lack a deep understanding of them. In most of these countries, the field of metrics still remains a fairly unexplored

topic because of associated time constraints and cost. Furthermore, the lack of reliable data is also a major concern in the green invention context, which prevents organizations and enterprises from measuring impacts effectively. While several green SGBs are tracking their environmental impact, they are not doing so in a standardized way. It is easy to capture impact as an output, but it is much more difficult to capture impact as an outcome.

Opportunities

Entrepreneurs would benefit from training with CDPs and research institutions on how to leverage existing tools such as IRIS⁴⁰ and GIIRS⁴¹ to target and collect data linked to their success measures. CDP's and research institutions could potentially offer training in using these tools in a coordinated way at a much lower cost than if green entrepreneurs had to access them individually. Similarly, the creation of reliable data could be enhanced if universities and research centers are

called upon to collect data alongside green SGBs. One notable example from the roundtables was the use of metrics in the Indian cook stove industry. Entrepreneurs measured the impact of driving the adoption of cook stoves and were able to see that they could partner with other green inventors who had the same customers, e.g., water purifiers and cook stoves, then collaborate in measuring impacts for each other, which in turn would decrease cost. Comparatively, in Kenya, the SGBs are tracking data because investors and supporters are asking for it. It was suggested that more stakeholders should ask for impact metrics and also provide ways for their beneficiaries to access those metrics. The ultimate goal is for green inventors, investors, and governments to use this information to make decisions and take strategic actions to enhance the effectiveness and profitability of the green sector.

EFFECTIVE TECH TRANSFER

Effective tech transfer refers to moving technology that is developed in a university or government entity into the marketplace. The countries in these roundtables generally have ineffective tech transfer processes that take a long time and are constrained by the red tape of bureaucracy. One of the roadblocks that forces this problem to persist is that some inventors prefer to keep the technology in these institutions because they financially depend on universities and research centers who own the technology. Unfortunately, ineffective tech transfer stymies local innovation. To aid in effective tech transfer, one suggestion is to hold specific interventions or events to bring industry to Tech Transfer Offices (TTOs) to view their products. One recommendation is to set up a roundtable that presents projects within TTOs to investors around a specific topic. Another example is in Brazil where a university tech-based innovation center has been successful in transferring inventions from the university to the market.

RECOMMENDATIONS

The roundtable discussions identified several key ways the ecosystem can strengthen green invention-based businesses. First, there are several capacity-building opportunities that could resolve the challenges green inventors' face in scaling up their businesses, in addition to a general need for more CDPs geared specifically toward supporting green invention-based SGBs. ANDE recommends:

- Generating awareness of the importance of green inventions that directly address environmental issues
- Generating awareness of the need for invention-based businesses to use new mechanisms and technologies to limit their environmental footprint
- Identifying and mapping intermediaries who support entrepreneurs in different business stages and making this information available to inventors and entrepreneurs
- Creating mentoring programs with legal and finance experts that align with different business model needs
- Creating an online crowd-sourcing platform that sources solutions in a collaborative way with the participation of a broad swath of ecosystem actors
- Creating effective models to incubate green enterprises that are not initially economically viable, but which have the potential to become sustainable
- Providing virtual trainings and partnerships between market intermediaries and universities to ensure invention occurs in a several geographies at once
- Involving corporations as partners in the training of green entrepreneurs
- Building an information sharing network where entrepreneurs can be directed to the right support systems
- Encouraging TTOs, incubators, and accelerators to be more focused on market development
- Incentivizing researchers to commercialize products and increase partnerships with SGBs
- Training experts who can support green inventors in the intellectual property and patenting process

Second, the finance opportunities for each country's green invention sector were observed and analyzed for applicability, ease of access, sustainability, and scope. We recommend the following to better support the financial sustainability of green entrepreneurship:

- Promoting funds that are environmentally sustainable that provide financial opportunities aligned to the specific needs of invention-based entrepreneurs
- Creating green impact bonds in order to lower the cost of financing green inventions
- Creating a funds database divided by sectors and business stages



- Developing a tool or platform between entrepreneurs and investors that represents entrepreneurs' ideas and business models
- Overcoming early-stage funding gaps by promoting opportunities for attractive

returns from investing in early-stage green businesses and taking them to the point of bankability

- Encouraging banks to create products specifically tailored for green inventions

Third, the policy and regulatory environment in which green inventors and entrepreneurs interact was reviewed in each country. ANDE recommends the following policy improvements:

- Encouraging government entities to work alongside green inventors to build more effective policies in technology transfer, research, procurement, and trademark and patent registration
- Working with governments to create policies that incentivize invention-based businesses to limit their environmental footprint
- Creating incentives for public universities and governmental agencies to be rewarded for new inventions that solve environmental issues
- Improving coordination between universities where technology transfer could occur more effectively
- Facilitating technology transfer from research centers and universities to other institutions to transform inventions into businesses
- Engaging CDPs to work more closely with chambers of commerce and other local associations to support effective policy for green invention
- Encouraging stronger collaboration and communication with corporations and governments to better understand market needs, as well as partnering to address them
- Creating platforms for public sector engagement with innovators in a collaborative format, i.e., linking innovators and policy-effectively

Lastly, the metrics and measurement opportunities and gaps were analyzed in each country's context for utility, affordability, ease of access, and applicability. The roundtable discussions for each country revealed an overall lack in information on metrics. ANDE recommends the following:

- Facilitating metrics training programs for green inventors and investors
- Educating green inventors on why metrics are necessary for accurately measuring environmental impact
- Defining a standardized way of measuring the impact of green inventions using a specific tool and indicator framework
- Improving the access to reliable data through the collaboration of universities, CDPs, research centers and green entrepreneurs

Overall, there are many opportunities for green inventors to thrive in emerging markets; however, there are also still many obstacles that must be overcome in order to make environmentally sustainable invention successful. There are many ways that local ecosystems can be improved to support invention-based SGBs, and many of the improvements require collaboration of key players in green invention. If the ecosystem components mentioned in this report are adequately nurtured, green SGBs have the ability to create highly marketable and impactful products for the benefit of local communities and the global community at large.



AREAS RIPE FOR ADDITIONAL RESEARCH

While ANDE hopes that the roundtables and this report have provided a foundational knowledge for the green inventing sector, it has become clear that additional research could prove helpful in moving green invention forward. The following is a list of areas for additional research and exploration:

1. How to increase access to industrial design support
2. How to involve end consumers in the design of green products
3. How to enhance market analysis through improved metrics
4. How to develop the business case for environmental sustainability
5. How to increase mentorship from environmental impact experts
6. How to integrate specialized talent within capacity development providers (CDPs)
7. How to integrate green SGBs into corporate value chains
8. How to develop better policies for the green sector
9. How to improve coaching of green inventors in the areas of capital raising and management
10. How to create incentives for corporations and governments to increase procurement from green businesses
11. How to create incentives for universities to collaborate
12. How to create incentives for researchers to commercialize inventions

METHODOLOGY

This report is a summary of the global roundtable discussions facilitated in 2015 and 2016 to determine what levels of ecosystem support are needed for invention-based businesses to promote environmental sustainability. The majority of the research presented in this report was collected from the aforementioned roundtable discussions held in South Africa, Brazil, Mexico, Kenya, and India. In total, 163 practitioners from 122 organizations attended the roundtables. The agendas for each roundtable were based on preliminary research and stakeholder mappings and were adapted for each event to focus on the issues most relevant to each region. The general categories covered in each roundtable include: capacity development, finance, metrics, and policy. Within each category, a subset of topics was explored that are specifically connected to the environmental concerns that invention-based businesses must address in these developing countries. These discussions were designed to foster active debate and help participants come up with collaborative ways to address ecosystem challenges.

After documenting and analyzing the preliminary research phase that included stakeholder interviews and discussions from the roundtables, several key findings surfaced on the challenges and opportunities in the various ecosystems that prevent or enable green inventors from achieving financial and environmental sustainability. The findings in this study are presented by category (capacity development, finance, policy, and metrics) within the aforementioned framework and were observed in light of each participating country's context. A multi-dimensional approach to presenting these findings was employed due to the various levels of SGB participation in environmental sustainability. To explain, some countries in the roundtable discussions had more SGBs with environmental sustainability components, i.e., production processes, than others due to a variety of factors that are explored in this report. Therefore, our approach in presenting these findings incorporated the opportunities and challenges of SGBs who already have environmental sustainability components, as well as those who are still exploring the concept.



A special thanks to Avina for making
the Brazil roundtable possible.

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The following list of organizations are referenced throughout the report. This list can serve as a resource to learn more or potentially partner with the organizations listed.

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